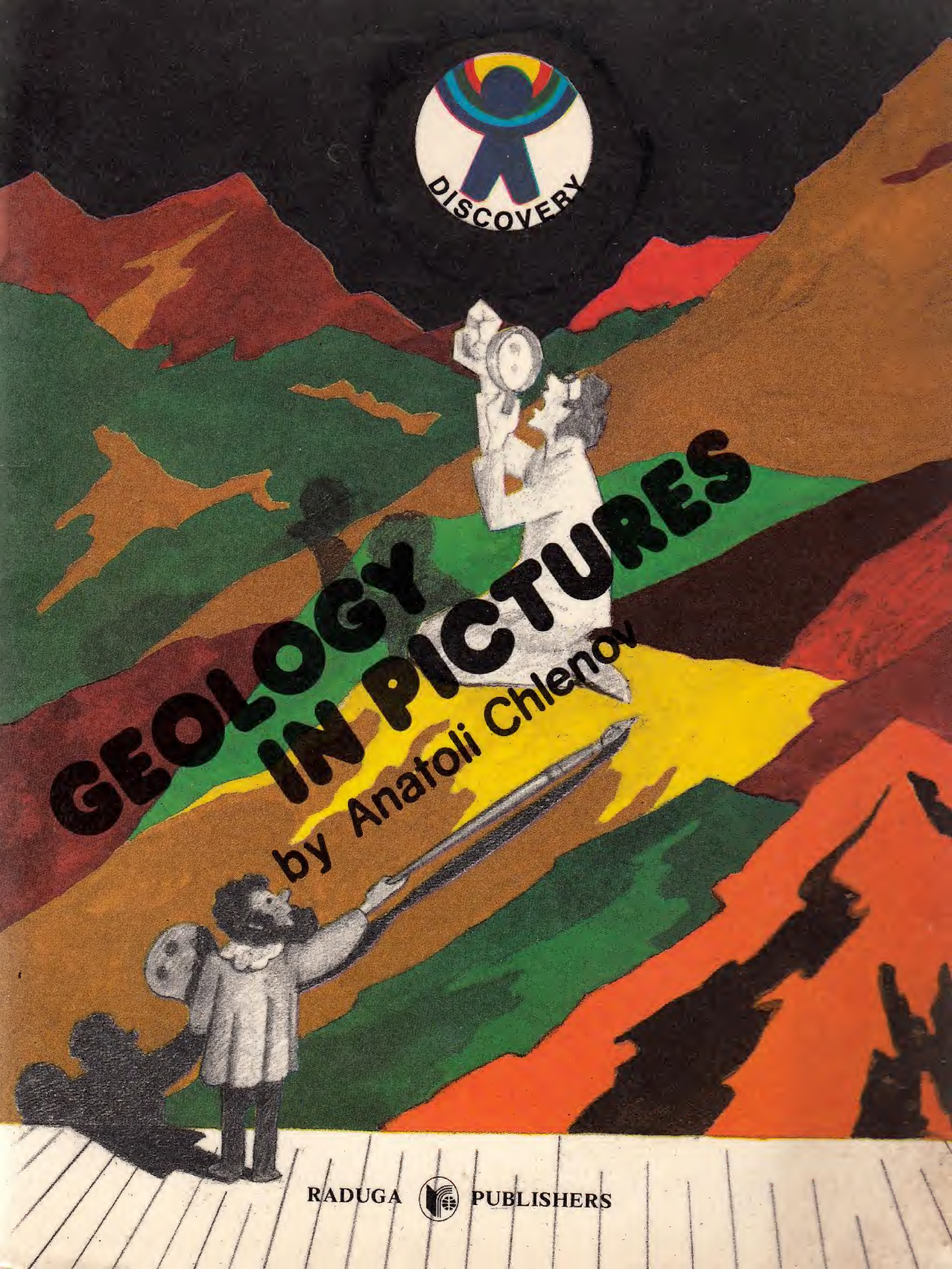
DISCOVERY
GEOLOGY
IN PICTURES
by Anatoli Chlenov
RADUGA PUBLISHERS

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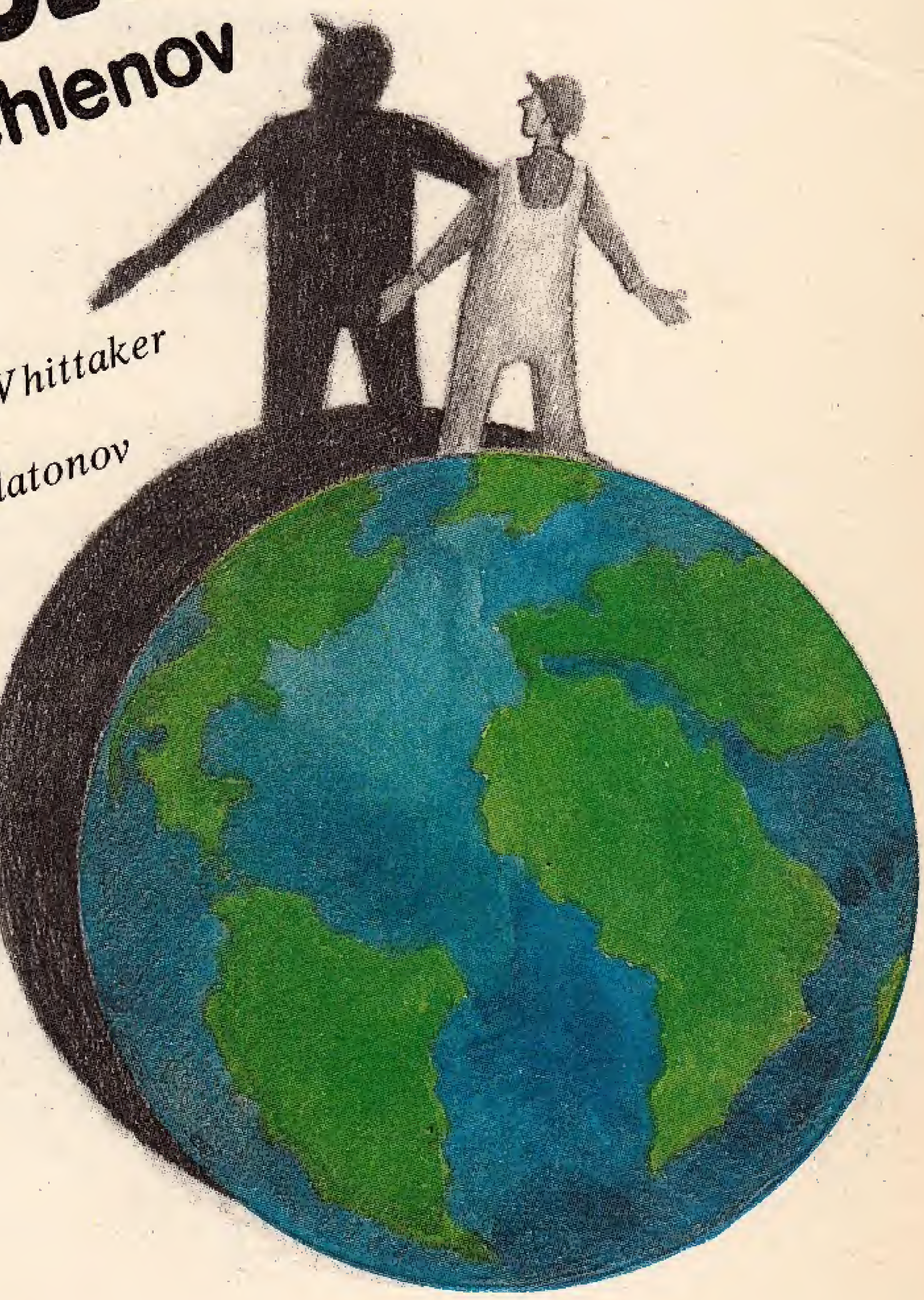

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1. WHO ARE GEOLOGISTS? WHAT IS GEOLOGY?

People in the mountains

A group of men is climbing up a steep mountain path. Each of the men is carrying a heavy rucksack and a hammer with a long handle.

It is not an easy path to walk along. The sun is blazing overhead, and from time to time stones rattle away from under the men's feet. One of the men suddenly stops, strikes on the rock-face with his hammer and breaks off a small piece of stone. He looks at the stone carefully, and puts it away in his rucksack...

...The men are on their way again along the mountain path, climbing further and further. Soon they are lost out of sight beyond a mountain pass, and all that is left is a song carried on the wind:

The road is long, the road is hard,
But there's no turning back yet awhile...
Press on, geologist!
Step firm, geologist!
You are brother to the wind and the sun!

So who are geologists? Why are songs sung about them?

This little book will tell you about geologists, about their hard and very necessary work, and also about the science of geology.

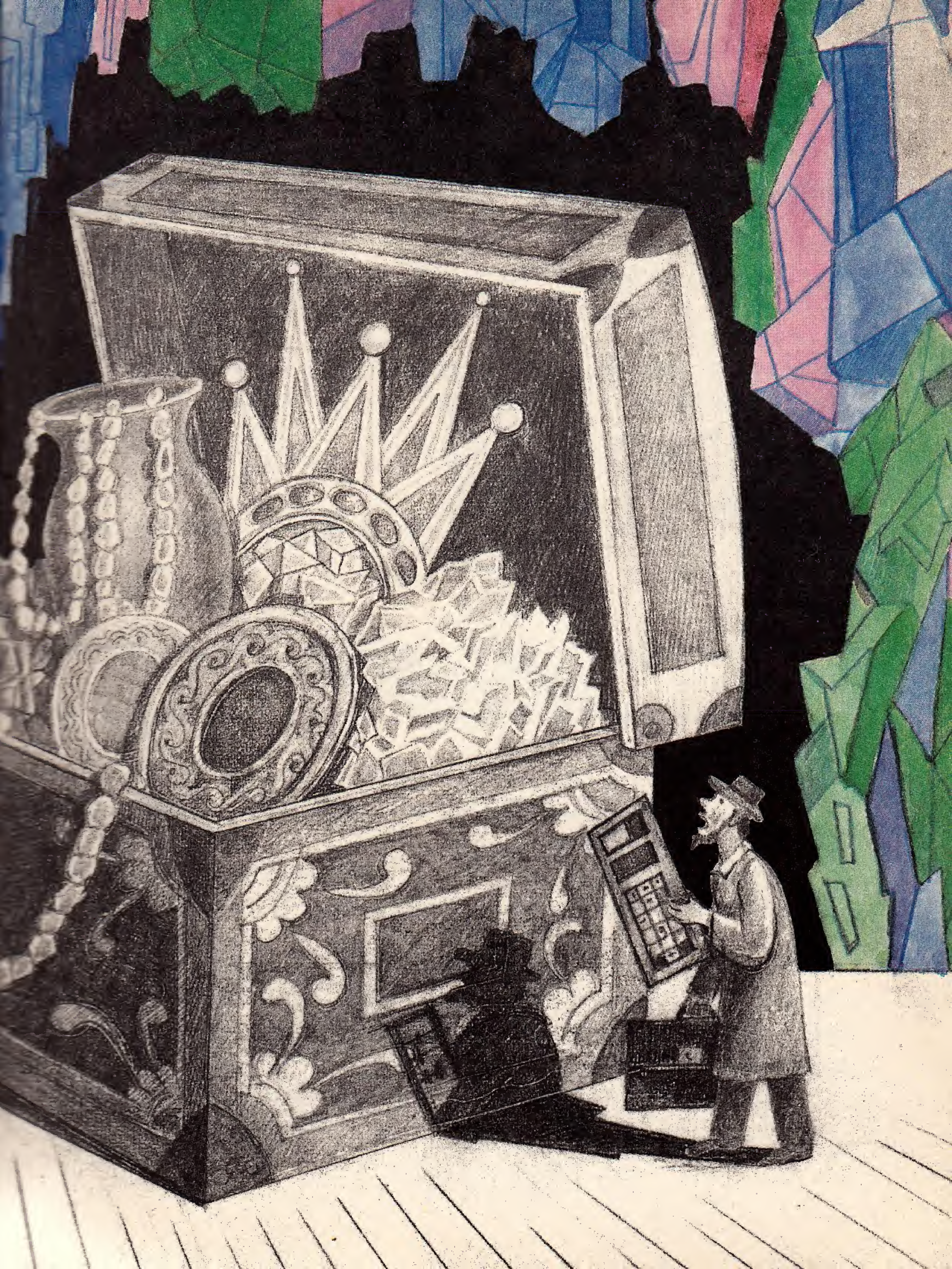
Geology? What is it?

Yes, what does it mean, geo-logy? Geology is a Greek word: *Geo* means Earth, the planet we live on; and *logy* is Greek for knowledge, or science. So have you worked out what GEOLOGY is? It is the science of the Earth.

Geology is one of the oldest sciences. When cave-men looked for hard stones for their axes, they were being geologists. In those distant times, of course, people only used what they found on the surface of the Earth. It was many thousands of years later before they learnt to use the riches hidden *under* the Earth's surface.

What are these riches? Why do we need them? I'll tell you...


H_2O



Look around...

Look at the things around you. There's a hammer and pincers, and a box of nails. They are all made of metal. There's the kettle, and your mother's iron, the frying-pan and the gas-stove. They are also made of metal.

Look out the window. There are cars on the road, and up in the sky there is an aeroplane. These, too, are made of metal.

Wooden chairs, glass beakers, books and all your clothes—trousers and shoes, shirt and socks—these are not, of course, made out of metal, but they could not have been made without metal.

To make these things we need tools and machinery. And tools and machinery are made of iron and steel and other metals.

So where do we get metal from?

Metal is smelted from ores. And ores are found by geologists.

An inter-planetary spacecraft hurtles through the open expanses of the universe.

A powerful cross-country vehicle travels over land where there are no roads.

A tractor pulls a heavy plough behind it.

And all these machines need fuel to keep them moving. And finding this fuel is the work of geologists.

If you move into a new house, or go down into a station of the underground, remember that it is geologists who decide where to build.

They study the ground and say: "You can build a house here," or "You can lay your underground tracks here." In a different place they say: "No, you can't build here, the ground won't hold, everything will collapse."

You can't start building without geologists, and there would be no factories, no aeroplanes or cars. Nor would there be any of the thousands of machines and other things which surround us and which are so necessary to us.

So that is the sort of science geology is! We can't even live without it.

2. THE EARTH'S STOREHOUSES

What are mineral deposits?

Geologists undertake long and difficult journeys. They have to cross turbulent rivers, make their way through dense forests, pass over dangerous swamps, or climb high mountains.

So why?

They are looking for MINERAL DEPOSITS.

Coal, oil, crop fertilizers, chalk for writing on the blackboard, gold, silver, diamonds, marble—these are all to be found in mineral deposits. They are hidden deep under the Earth's surface. Geologists look for them, and find them, and that is why they go on long and difficult expeditions.

Some minerals can be used just as they are found. Coal, for instance. It is brought to the surface from deep down in a mine, and it can be put straight onto the fire—it will burn very nicely. Or chalk: dig up a piece and you can start writing.

But there are other sorts of minerals. These need something doing to them before they can be used. When iron ore is dug up it is just like any other stone. And to get iron or steel out of it, it has to be smelted in a blast furnace. Oil also has to be processed—or refined—to get paraffin, petrol and all the many other things which can be made out of it.

What colour is coal?

"Who doesn't know that?" you will say. Everyone knows that coal is black. There's even a saying: as black as coal.

Well, yes. More often than not, that is right. But not always! There is not only black coal, but also yellow coal—sometimes called *shale* and there is coal that is the colour of gold. There is even a bluish coal, rather like copper ore.

But where does coal come from?

Coal is a very hard substance, like stone. For a long time it was thought that coal was a type of stone, and it was even called *stone-coal.*

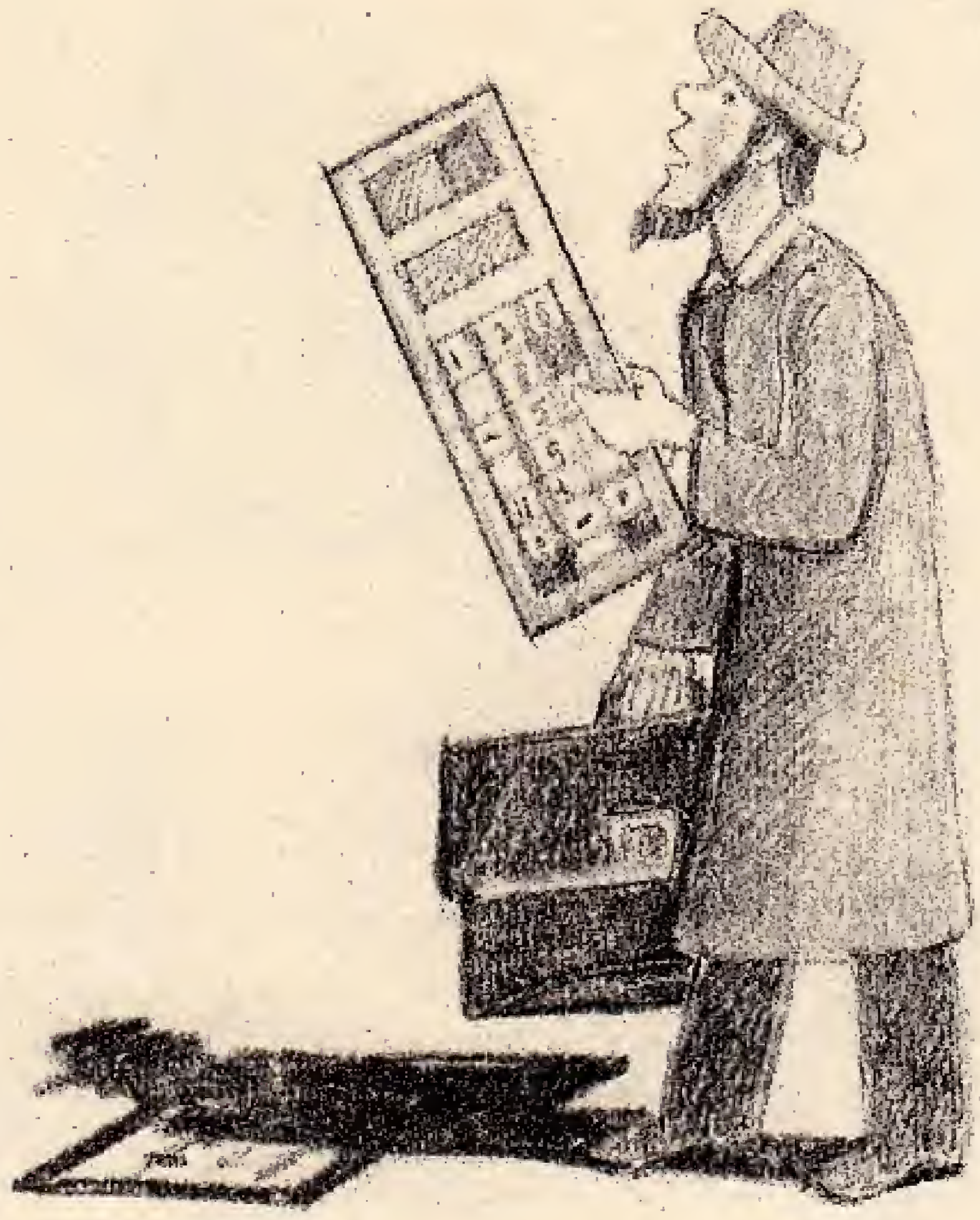
But stones don't burn. So why does coal give off flames? The great Russian scientist Mikhail Lomonosov, in the 18th century, showed that coal was formed from ancient trees and plants which had been growing on Earth in distant, pre-historic times.

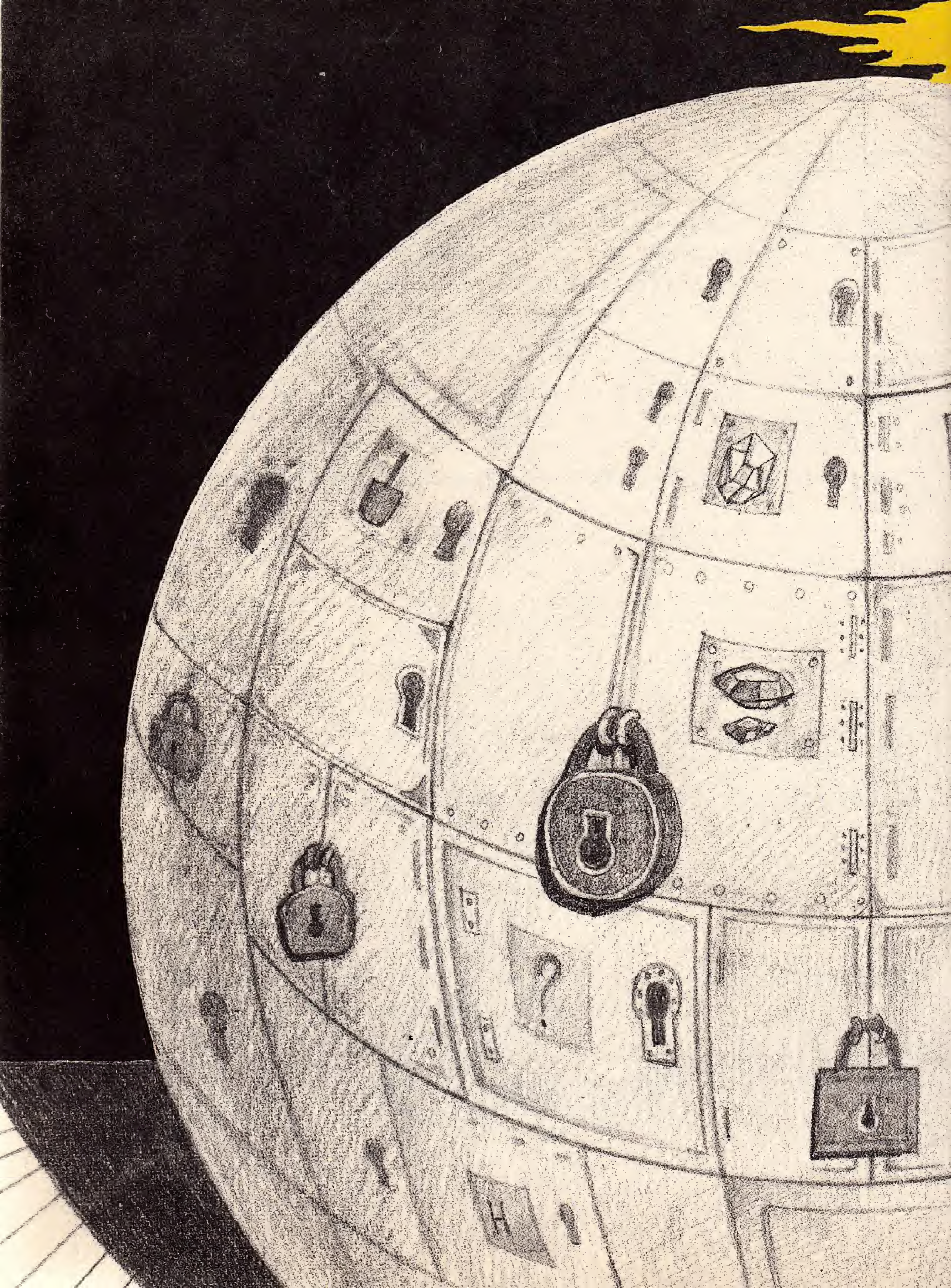
And everyone knows how well wood burns.

Of course, trees are not at all like coal. Nor are flowers. But if you look at a piece of coal under the microscope you will be able to see the plant fibres in it.

Coal is something everyone needs. We have learnt to make from it so many useful and necessary things: coke for blast furnaces, and very much more.

Geologists throughout the world are continually finding new deposits of coal.





Let me tell you about cement

For every building made of stone or brick we need cement. No house, bridge or factory can be built without it. It is mixed with water, and with sand or clay, to give an excellent and extremely strong building material.

So what *is* cement? Where does it come from?

I will tell you about one place it comes from...

A very long time ago, in the place where the Caucasian mountains now stand, there was once a huge sea. As the waves on this sea pounded against the shore they gradually washed away part of the land, and what they washed away came to settle on the sea bed. In time this layer of sediment at the bottom of the sea grew thicker and thicker, the weight of the sea water pressed down on it, squeezed it and turned it into a hard rock, called *marl.*

Many thousands of years later mountains began to grow up in place of the ancient sea. Through the terrific power of earthquakes the thick layers of marl rose up out of the depths of the sea and came to the surface of the dry land.

People in time began to take notice of marl, and they learnt to bake it and grind it down. This gave a very fine, greyish powder, which we call cement.

This ancient rock, formed at the bottom of pre-historic seas, and of no use to anyone, finally began to serve mankind.

Black gold

People in hot countries long ago used to notice a thick, dark-coloured, smelly liquid which oozed out of cracks in rocks. If it leaked into water, it would spread out over the surface in huge rainbow-coloured patches.

The liquid was oily and it burnt well. Because it came out of rocks it was called *rock oil.*

But then this rock oil began to be found in forests, in swamps, and even at the bottom of the sea. So the liquid's name was shortened to just *oil.*

Scientists discovered that oil did not come from rocks at all. Just like coal, it was formed deep under the Earth's surface from the remains of ancient plants and trees. You could say that coal and oil are related to one another in this way.

At first oil was used to make medicines, and was burnt to give light in the darkness. But as soon as motors were invented, oil became the main fuel for them. Petrol and paraffin both come from oil.

We have also learnt how to make paint and varnish out of oil, as well as medicines, artificial rubber, synthetic fabrics and plastic. And there are thousands of other useful and necessary things made out of oil today.

Geologists are finding new deposits of oil all the time. In the Soviet Union oil is found in the northern taiga forests, in the plains around the River Volga and at the bottom of the Caspian Sea.

Water, water, everywhere

What do you think could be simpler and more common than water? You just turn on a tap, and a stream of clear, transparent water pours out. Or you can draw a bucket of water from a well, for example. So what? There's nothing special about it, is there? Quite normal, you might say.

But without water, you couldn't have a wash, or a cup of tea. And you couldn't cook without it. Forests would dry up and die without water, and you would get no more harvests from the fields. Not a single green leaf, no human being, no animal at all can live without water.

"So what?" you may ask. There are rivers and lakes, seas and oceans. We can take water from these, we can take as much as we need, you might say.

But no, we can't. There isn't enough water on Earth at all.

Teams of geologists are working in the dry lands of the south, in the desert regions. They are looking for water where there are no rivers and seas. They are looking for water under the Earth's surface. So you see, water too is just like a mineral deposit. It is useful, necessary, and can be found by geologists.

In the far south of the Soviet Union there is a desert. This desert covers a huge area, and whichever way you look there is sand, sand and more sand as far as the eye can see. So how can we make plants and trees grow there, how can we make it possible for people to live and work there? To make all this possible, we need just one thing—water. Lots of water.

And that is why teams of geologists set to work in the desert. They built a special drilling rig and started drilling a deep hole in the sand. They dug deeper and deeper, and they knew that down there, in the very depths, there should certainly be water.

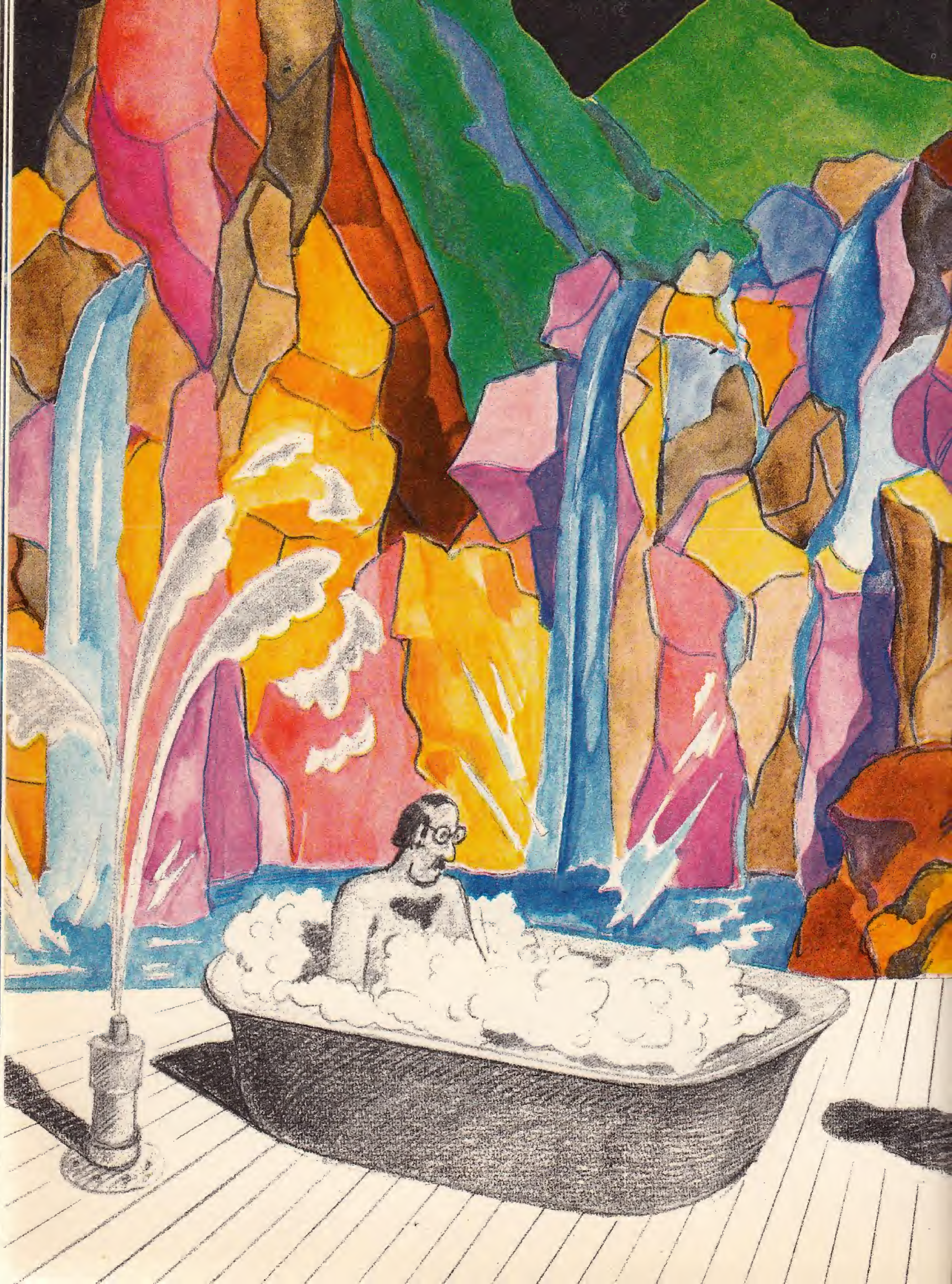
Then one day they noticed that the sand was darker and heavier. One man put a handful of the sand to his sun-burnt cheek, and exclaimed:

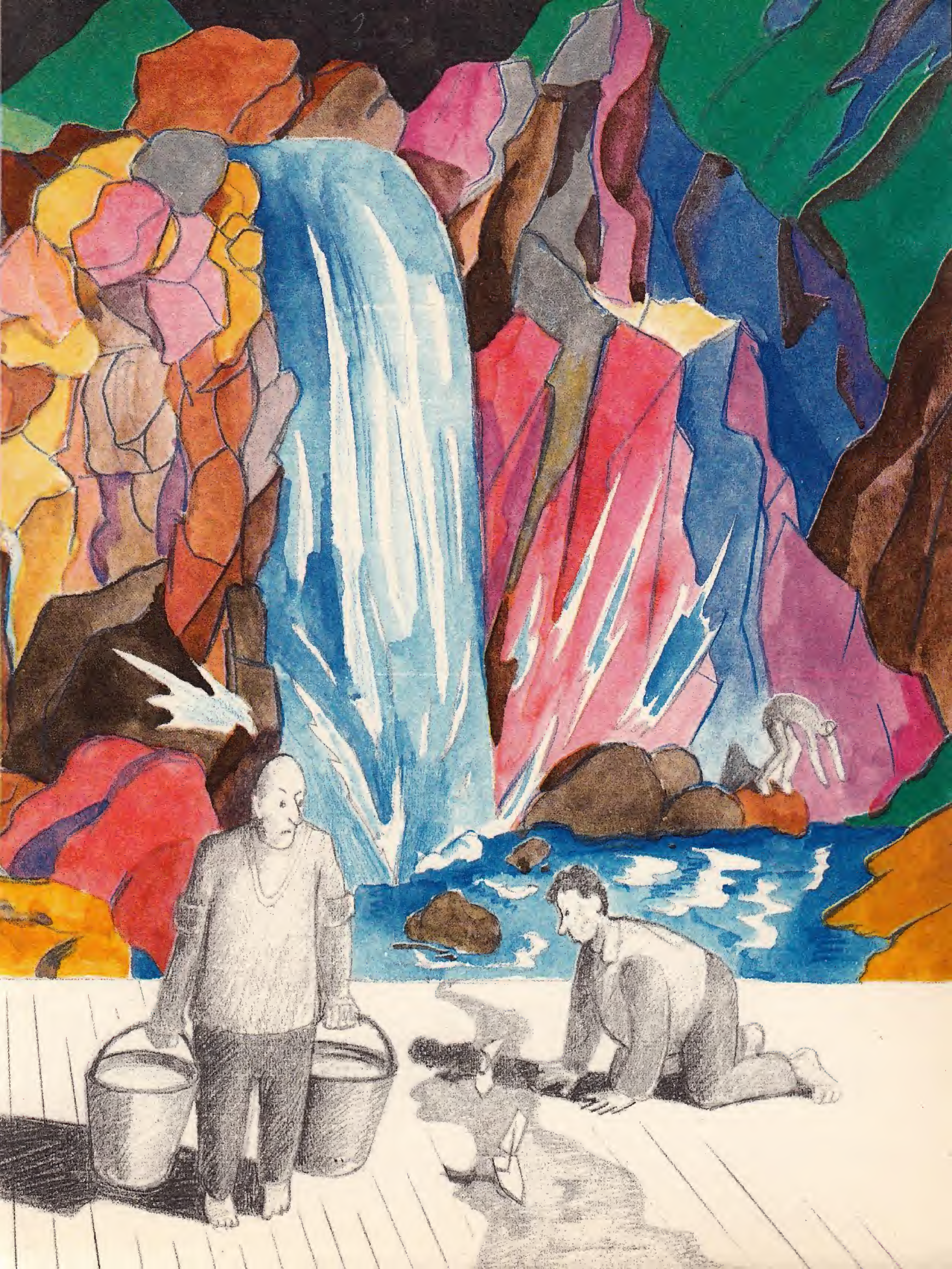
"It's wet!"

The geologists set to work again with renewed energy. And then came the day when they brought up pure water from deep down below the desert sands. It was like a big holiday.

The geologists continued working in the desert, and they made an important discovery: below the desert there was a huge underground lake.

There will soon come a time when gardens will blossom in the desert. Beautiful cities will rise up among the greenery. Water will bring life to the barren desert sands.





The sun-stone

Once upon a time, about 150 years ago, there lived a young boy in the Ural Mountains. His name was Pavlik Popov. One day he was walking along a mountain path and came to a place where there were many stones lying on the ground, or a *scree* as geologists call it. These were stones of all sizes which had rolled down from the mountain slope above.

Pavlik began to sort through the stones. He would look at one, turn it over in his hands, then throw it away. Then he would pick up another, and throw it away, then another, and another... They were all just ordinary stones, nothing interesting about them at all. But then he picked up a most remarkable stone. Whenever a ray of sunlight fell on it, it flashed with a blue, red and green fire. It was as though the stone had its own miniature sun inside it. Pavlik showed the stone to his father, who took just one look at it and exclaimed:

"Pavlik, my lad, that's a diamond you've found! It's as precious as precious can be! You really are a lucky lad!"

Lucky, because it was such an unexpected find. Almost accidental, you might say. Pavlik, for example, might not have noticed the stone at all. Or he might have gone walking in a different place altogether. And then he would never have found the diamond. It really was a lucky, accidental find.

But now let's think about the geologists in the desert. Do you think they, too, made a lucky find? Did they, just like Pavlik, find what they were looking for simply by chance? No, of course not! Geologists can't just rely on luck. So, of course, they knew beforehand that they would find water under the barren sands of the desert. Let me repeat, they KNEW! But how did they know?

Imagine for a moment a hunter in the forest. He looks around him carefully. On the fresh layer of snow he clearly sees animal tracks or other traces. And these traces tell him what animal it was that passed this way, and in what direction it was going. The hunter understands the language of animal traces, and the forest is like an open book to him. He will never come home empty-handed from the hunt.

And a geologist is like a hunter. Except that he hunts for mineral deposits, not for animals. And a geologist, like a hunter, does not hunt blindly and trust to luck. He searches for the traces of mineral deposits. Of course, mineral deposits do not leave the same sort of traces as animals do. To understand them a geologist has to know a lot of things. He must, for example, examine the rocky debris left by ancient volcanoes. And if he knows what kinds of chemical elements usually accompany a particular deposit, he may often discover interesting mineral deposits. In general, a geologist must be able to read the Earth's book of wisdom. And the science of geology helps him in this.

3. THE SCIENCE OF THE EARTH

The secrets of our planet

If you remember, I told you that geology was the science of the Earth, the planet we live on. But we also have the science of geography, and this too is a science about the Earth. How come? What's the difference?

Let me explain. Geo-graphy is a drawing, or a picture, of the Earth. This science studies the Earth's surface and tells us where we can find the forests and the deserts, the seas and the mountains, it tells us where the various countries are and what nations live in them, and it tells us where all the different animals live.

That is the science of geography.

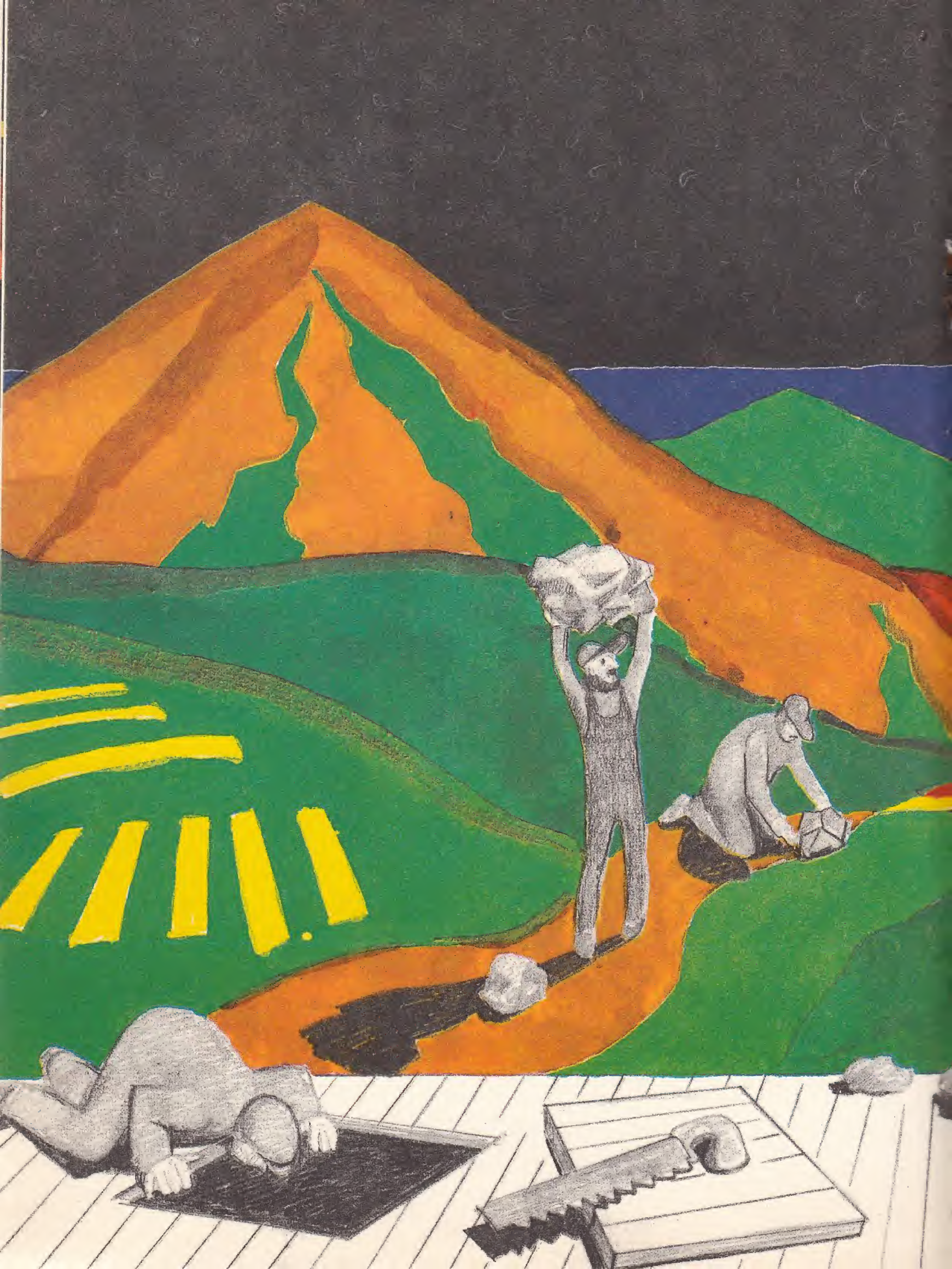
But geology is quite different.

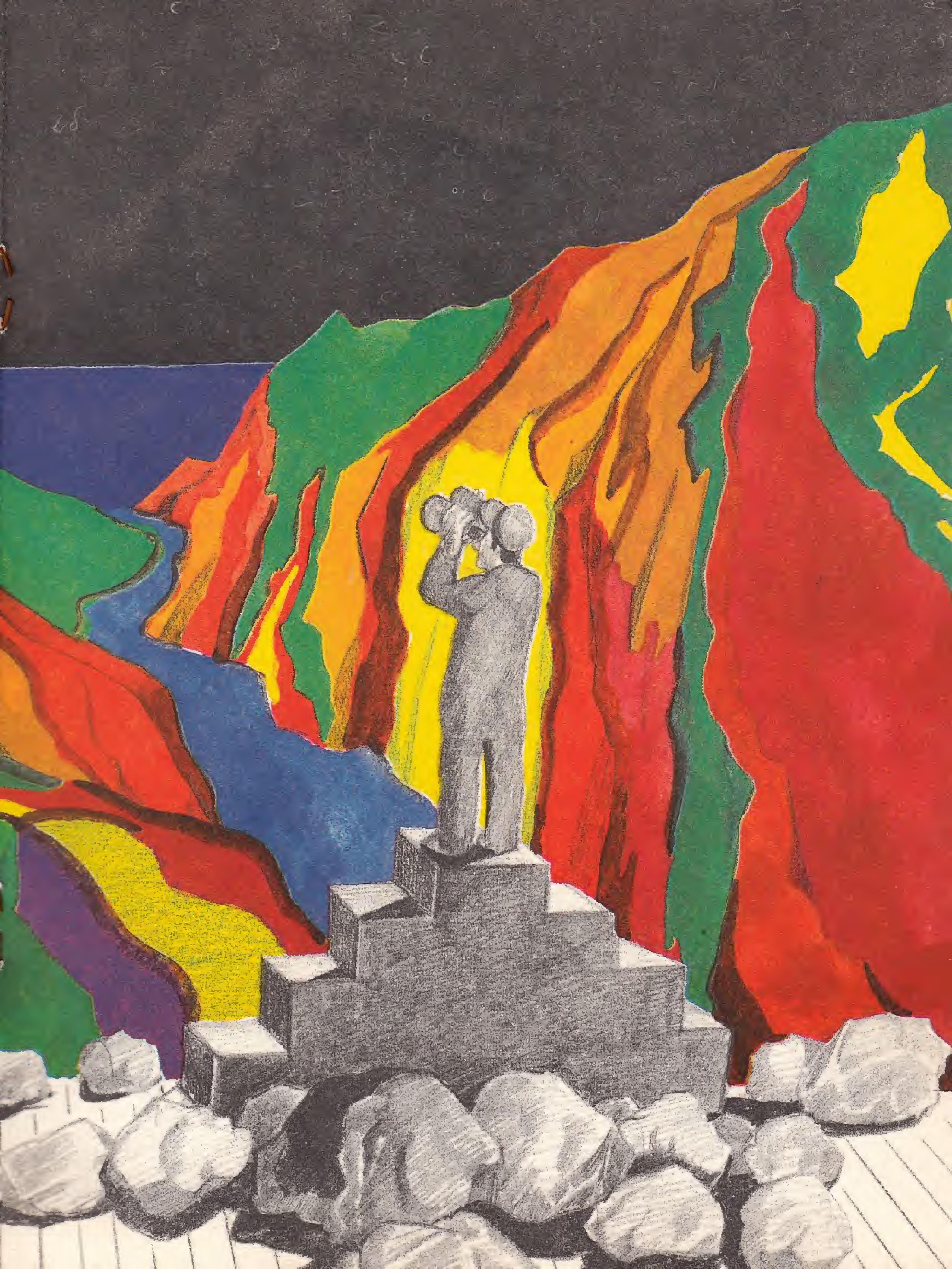
Imagine you are out for a walk. Suddenly you come to a gully. You cross over the gully and your path carries on along the level. Then gradually it starts to rise up into the hills.

So why was the gully there, how was it formed? Why does the Earth have hills and plains, dry land and sea?

Pick up an ordinary stone. Where has it come from? Why are there all sorts of different stones on the Earth?

So you see how many mysteries and secrets there are all around us. And it is geology which helps us to unravel the Earth's mysteries and discover its secrets. Geology is the science which tells us about the Earth's structure, how it has changed and what it is made from. It is the science of mineral deposits and where they can be found.





How was our planet formed?

Throughout history people have had different ideas on this question. But the development of science has gradually given a more precise and correct answer. Geologists studied ever more ancient rocks and thus looked further and further into the depths of time. Reading ancient rocks, like the hunter reads animal traces, geologists came to understand what our Earth was like many millions of years ago. But the actual formation of our planet remained a mystery, until astronomers came to our aid.

We all know that the stars shining in the evening sky are simply distant suns. And there are many millions of these suns in our galaxy. Astronomers look through powerful telescopes and see, apart from the suns, immense clouds of gas and dust in the emptiness of space. Under the influence of gravity some of these clouds are being drawn together into more solid masses and are turning into new stars. And this was how our own sun arose almost five thousand million years ago.

Part of the gas and dust which did not go into the making of the Sun was joined together in smaller masses. Some of these smaller masses joined together to form the planets as we now know them—the Earth, Mars, Venus and so on.

From time to time the remains of some of these smaller masses still fall down onto our Earth. And these are what we call meteorites. Scientists study meteorites in laboratories and can learn a lot about their history.

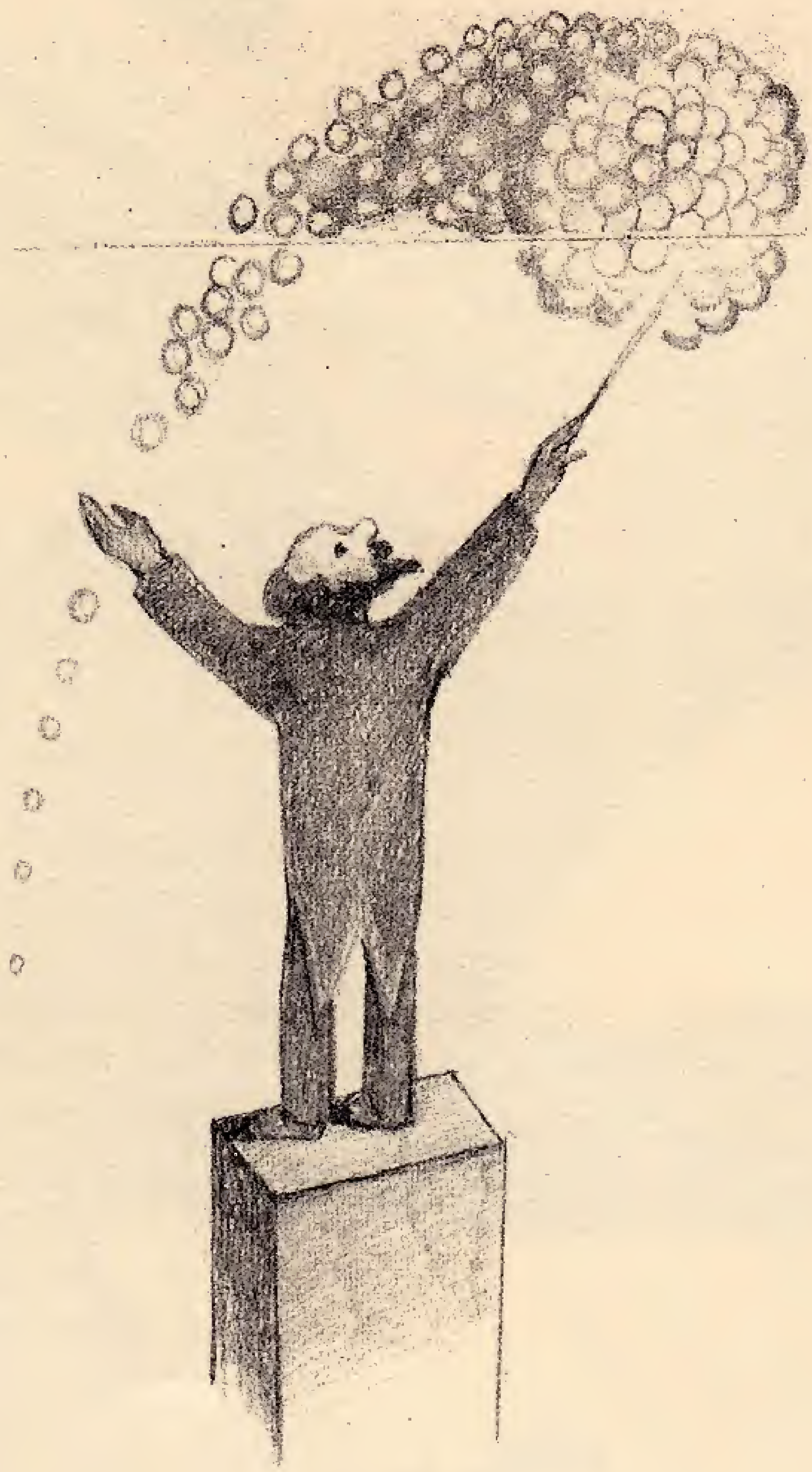
So why are these clouds of gas and dust drawn together into more solid masses? Why do some of these masses fall down onto others?

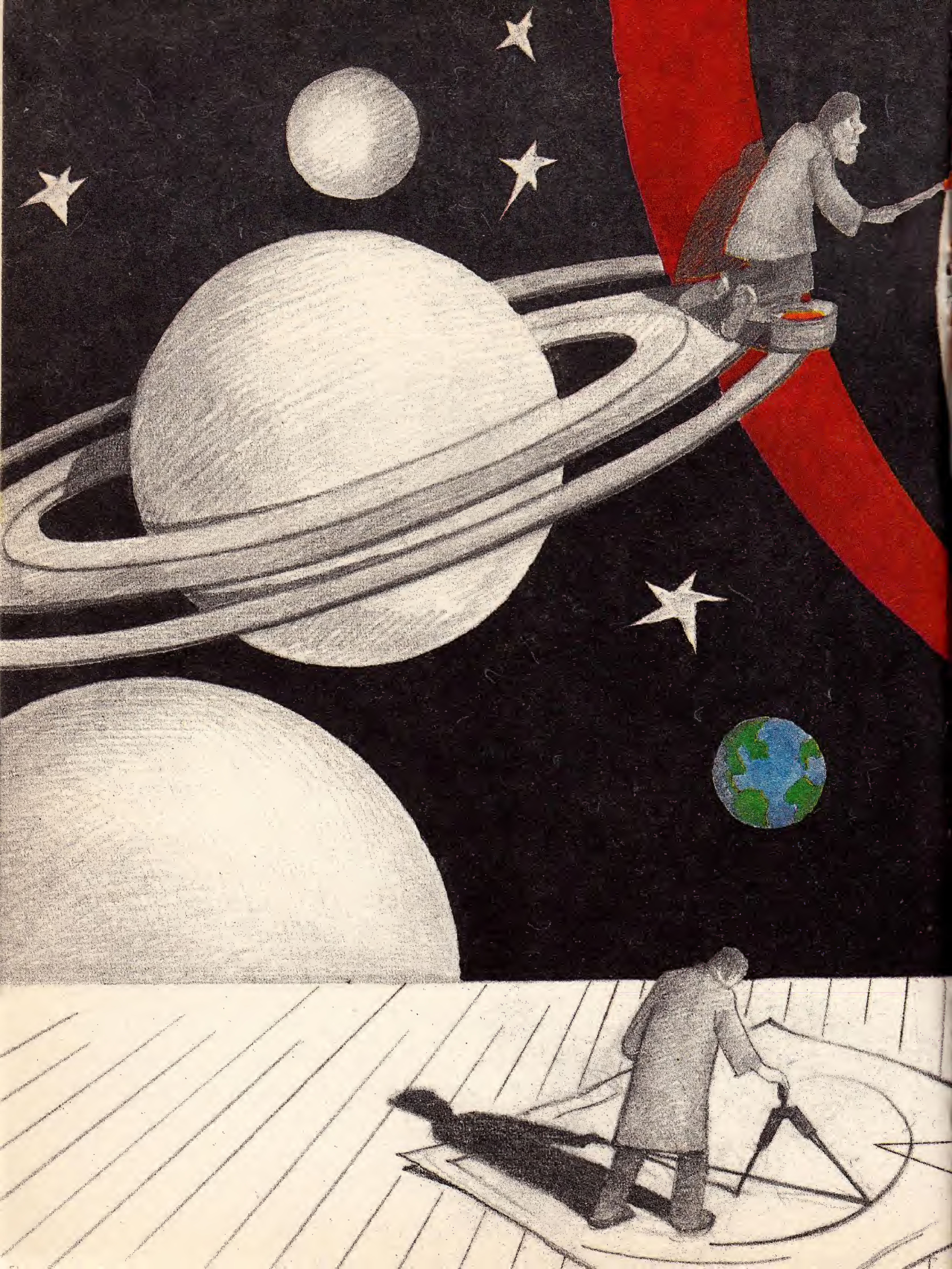
You know of course, if you throw a stone up into the air, then it will always fall back down again. We say that the Earth "attracts" the stone, and that the force of attraction exists between the Earth and the stone. This force of attraction is called *gravity*.

If you tie a ball—say, a tennis ball—to a piece of elastic and, holding the loose end of the elastic firmly in one hand, throw the ball, then the ball will fly away from you. But the elastic will stretch and stretch, and it will gradually slow down the flight of the ball. At last the elastic will be fully stretched, and it will start to pull the ball back towards you. The elastic "attracts" the ball back to you. Of course, there is no such elastic between the solid masses in space, and everything up there is far more complicated than this simple illustration, but you will learn more about this in school.

And if you visit a planetarium, you will be able to look at the Moon through a powerful telescope. On the Moon's surface you will see craters everywhere. These have been made by solid masses, both large and small, crashing into the Moon from outer space.

But now let us return to the Earth.





Where do mountains, seas and plains come from?

Now you know something about how our planet was formed. But the face of our planet is not fixed, it is always changing. In the beginning the surface of the world was lifeless, and deep within it there were complex chemical changes taking place. The molten mass of the Earth bubbled like porridge. The lighter rocky masses rose to the surface, and the heavier ones—containing metals—sank down. Thus the Earth's solid core was formed, together with its lighter coating, called the *mantle*. The surface of our planet was gradually covered with a hard, thin layer of rock, which we call the *crust*. This crust became wrinkled, like the skin that forms on milk that has been boiled.

These wrinkles formed huge lumps on the Earth's crust—mountain ranges like we see today.

While the Earth's surface was still hot, heavy clouds of vapour hung in the sky above. And in that distant time terrible rain storms lashed down all around the planet, filling up all the hollows, both large and small. These were the first seas and oceans.

But the molten mass of rock under the Earth's crust went on bubbling. We call this molten mass *magma*. From time to time this magma burst out through the crust, destroying everything in its way. Terrifying earthquakes tore down mountains and built them up again in different places.

The surface of our planet changed slowly. The first signs of life arose in the warm seas. The simplest types of plants, fishes and animals were then gradually replaced by more complex types. And it is by studying the fossilised remains of these early forms of life that geologists have discovered many interesting things: once upon a time, long, long ago, there was a sea where there are now mountains; and where there are now many islands there was once a whole continent.

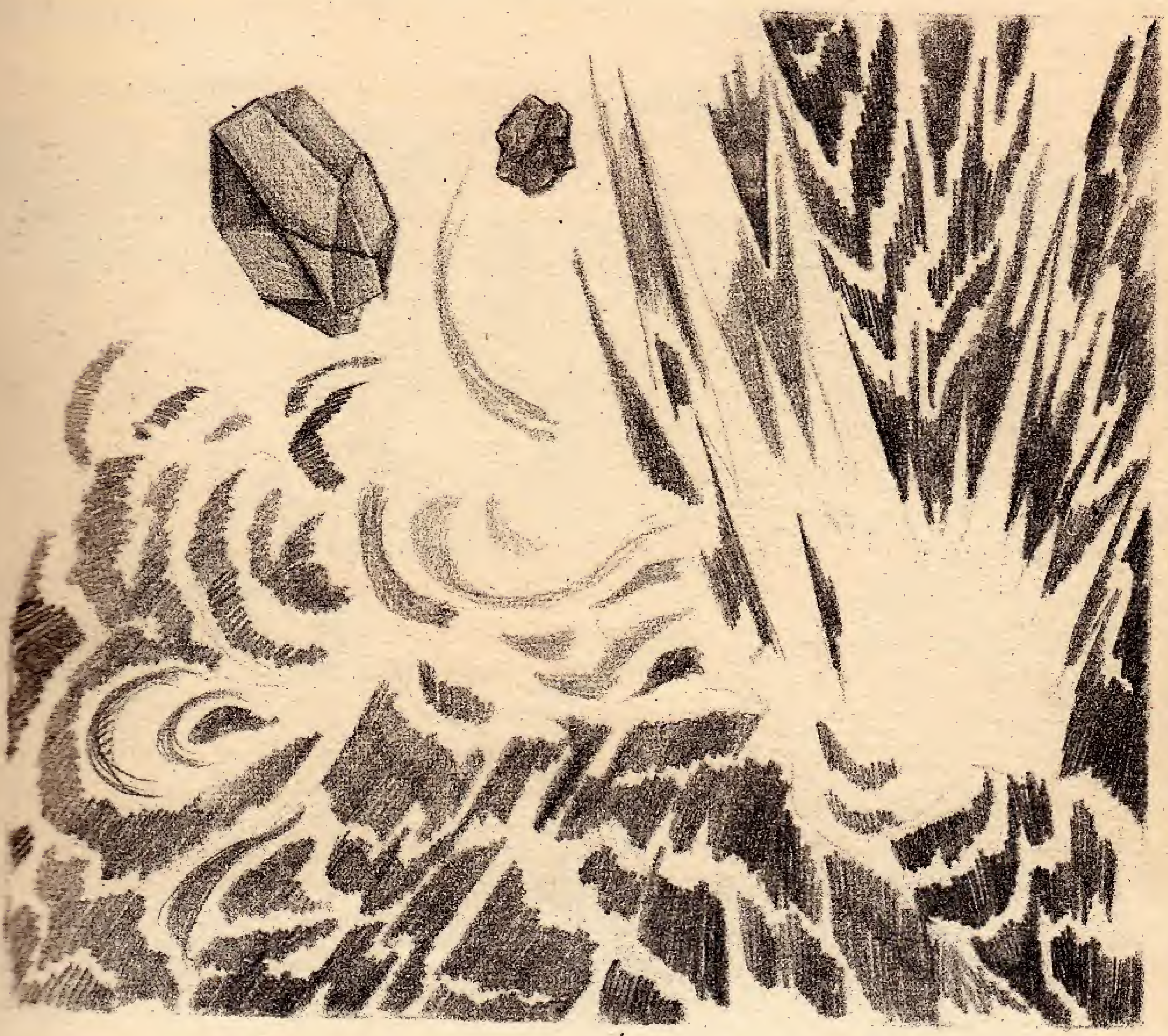
And is the face of the Earth changing even today?

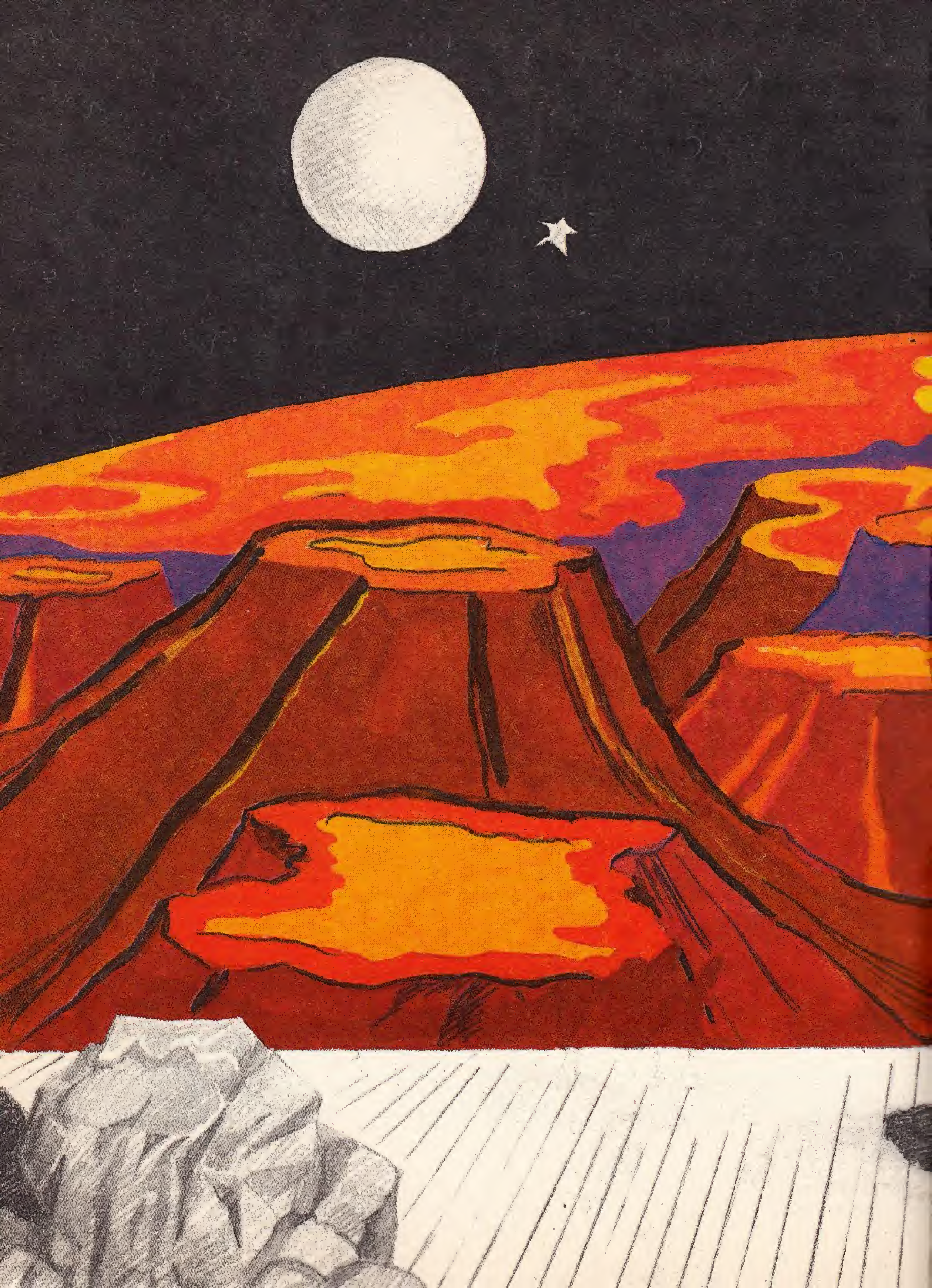
Scientists believe that deep within the Earth a tremendous amount of heat is being given off. It is as though our planet is being heated up from within. And the powerful forces of nature still cause volcanic eruptions today. The Earth's crust still trembles with earthquakes. And the continents are moving apart very slowly, so slowly that we cannot actually see the movement with our eyes.

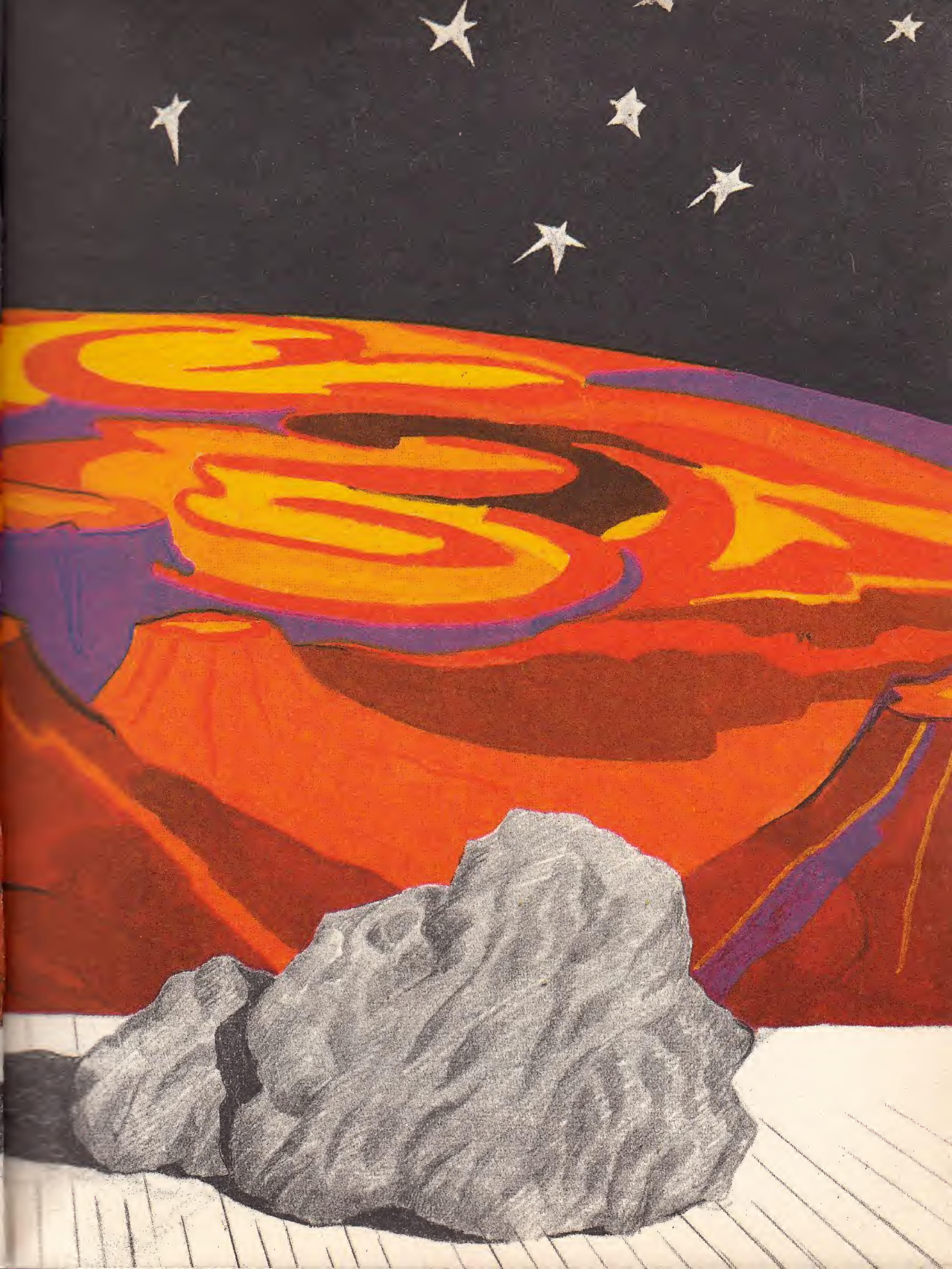
But the surface of the Earth is also being changed by outside forces.

So what are these forces?

Turn two pages and you will find out...







The Earth's great masters

Do you want to grow up, grow older? Of course you do! If you are patient, the years will pass by, and you will grow. Ask your mother for a photograph of yourself as you were when you were very small. Look at it carefully and you will see how you have changed.

Because you are growing all the time, gradually, you do not notice how you are growing bigger and stronger.

It is the same with our planet. It is changing all the time. But only very, very slowly, much more slowly than you are growing. But it is changing constantly.

If we build dams, then the rivers become wider. Even new seas can appear.

People plant forests, dig canals and dry out swamps. Man is making his planet more beautiful and better to live on.

But these are not the only changes in the Earth's surface.

A gully may appear—"out of nowhere". But no one built it. It just appeared.

There were high mountains in one place, but gradually they fell down. Now there is a broad plain in their place. But it was not people who destroyed them.

So why is the Earth changing like this? I'll tell you. It is the work of the great masters—water, wind and the Sun.

How do they work? Geology tells us how...

How they work

A clear spring once lived in a wood. A thin trickle of water forced its way out of the soil. The spring was very small indeed, and the forest was immense.

One grain of sand at a time, the spring dug a little hole for itself. After a while there was a small pool in the forest, a pool into which the spring poured its waters.

The spring went on gurgling, carrying on its work day and night.

The small pool slowly grew wider and deeper, and it became a small lake.

This lake didn't exist in the forest before, but now it does. It was made by the water from the spring.

One day a small stream broke out of the lake and ran away through the forest. There it met another stream. The two became friends and flowed on together.

In this way a lot of small streams came together and formed a river, flowing towards the sea and washing away its banks as it went.

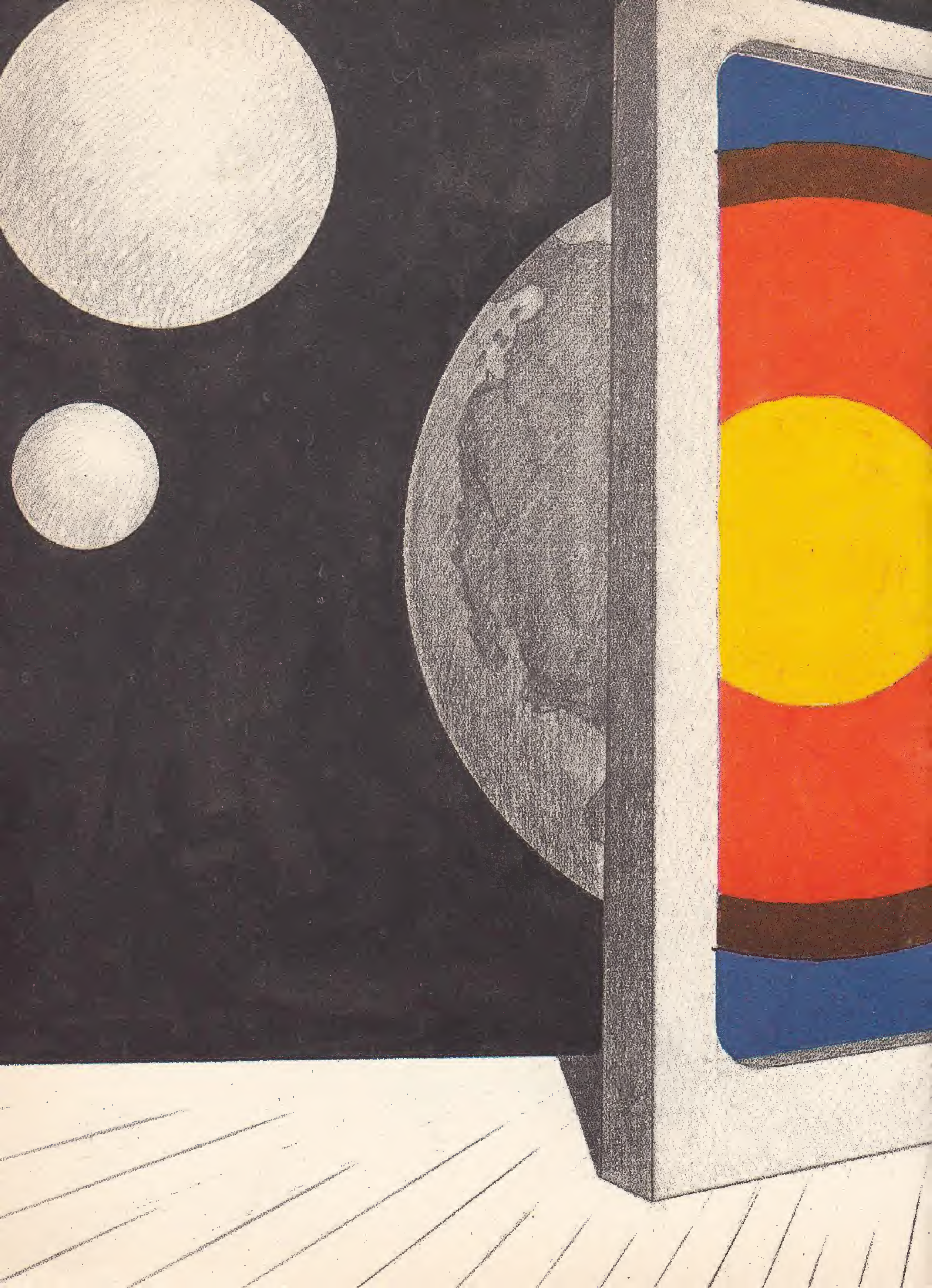
But there were mountains in its way. The river threw itself at the rocky mountains, as if to say: "Get out of my way! Let me through!" But the mountains didn't move. They were dark and gloomy, and not a single blade of grass grew on them.

The river grew angry, and began to froth. More and more waves rushed forward, pushing and crashing against the rocky mountains.

Then the Sun started to help the river.

The cliffs couldn't stand the heat, and they began to crack. And the water flowed into the cracks.

In the winter the water froze and made the rock break open even more. The cliff was now covered in cracks.



In the spring the wind blew soil and dust into the cracks, and the first green shoot showed itself in this soil. Soon a tall fir tree grew up.

Then the tree's roots began to help the water and the Sun to break down the rock. And next to the first tree there grew a second, and a third. The mountains became covered in forest.

The wind also did its best. It blew with all its strength and brought a hurricane. It tore down huge pieces of rock from the heights and threw them down into the ravines.

The water, the wind and the Sun worked together, and gradually they broke the mountains. The river found a way through to the sea, taking with it the water from the small spring where it had begun.

Underground cities

A lot depends on water in the life of our planet. But water doesn't only change the surface of the Earth, it also works deep underground.

Once upon a time some people were walking through a wood when they found a hole in the ground almost hidden in the undergrowth. They tried to find out how big it was by prodding at it with sticks. But even the longest pole could not reach the bottom. The people then knew that they had found a real underground passage. But where exactly did it lead?

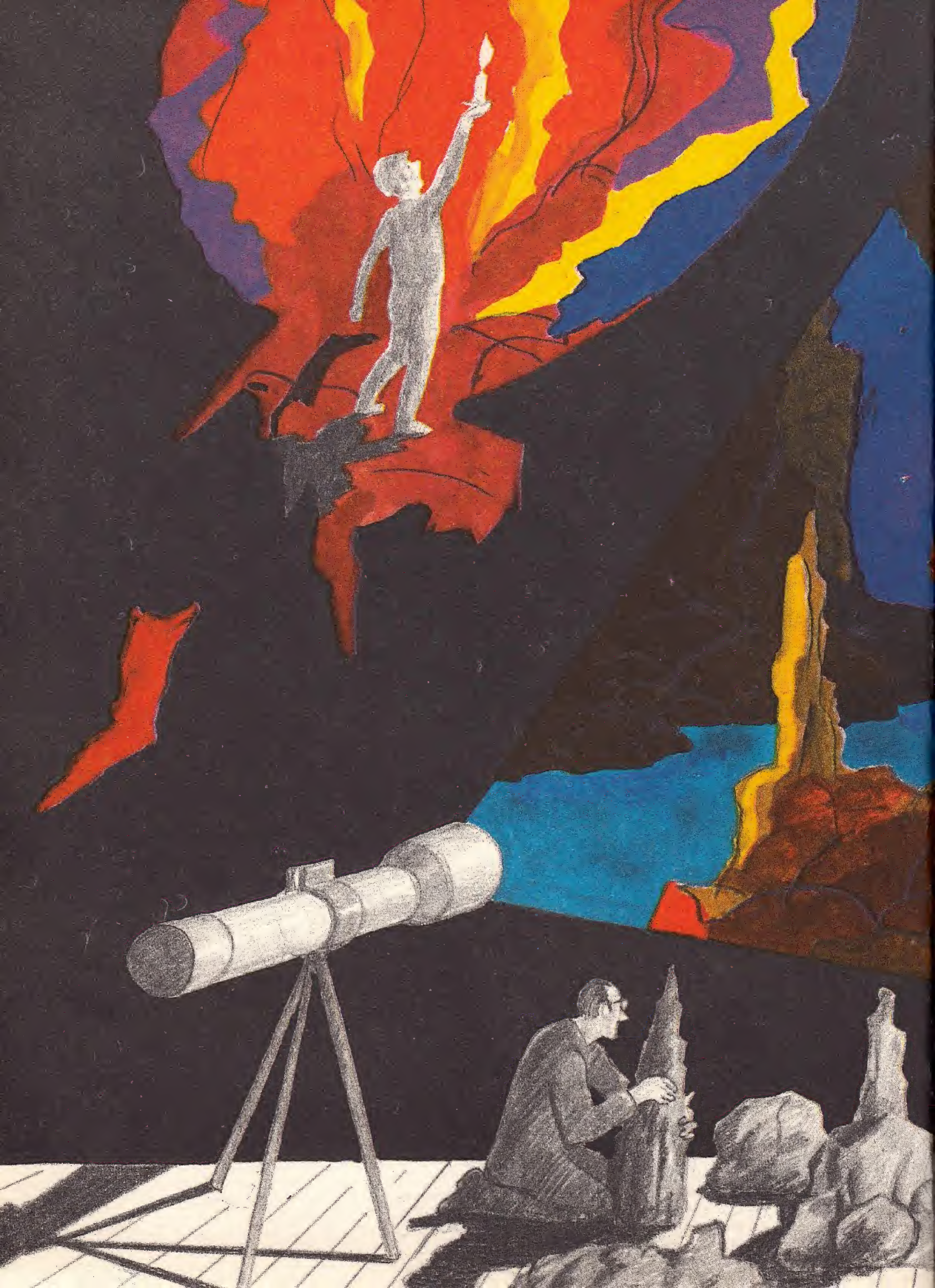
Geologists were told about the passage, and they arrived with torches and spades. They went down into the passage. At first it was very low and narrow, and they had to crawl their way along. But then it became wider and higher and they could walk properly. The underground corridor led the geologists further and further on. At last they came to a huge hall where their footsteps echoed resonantly. Their torches showed large pieces of rock lying around on the floor of the hall, and water was trickling down the walls. This was a natural cave.

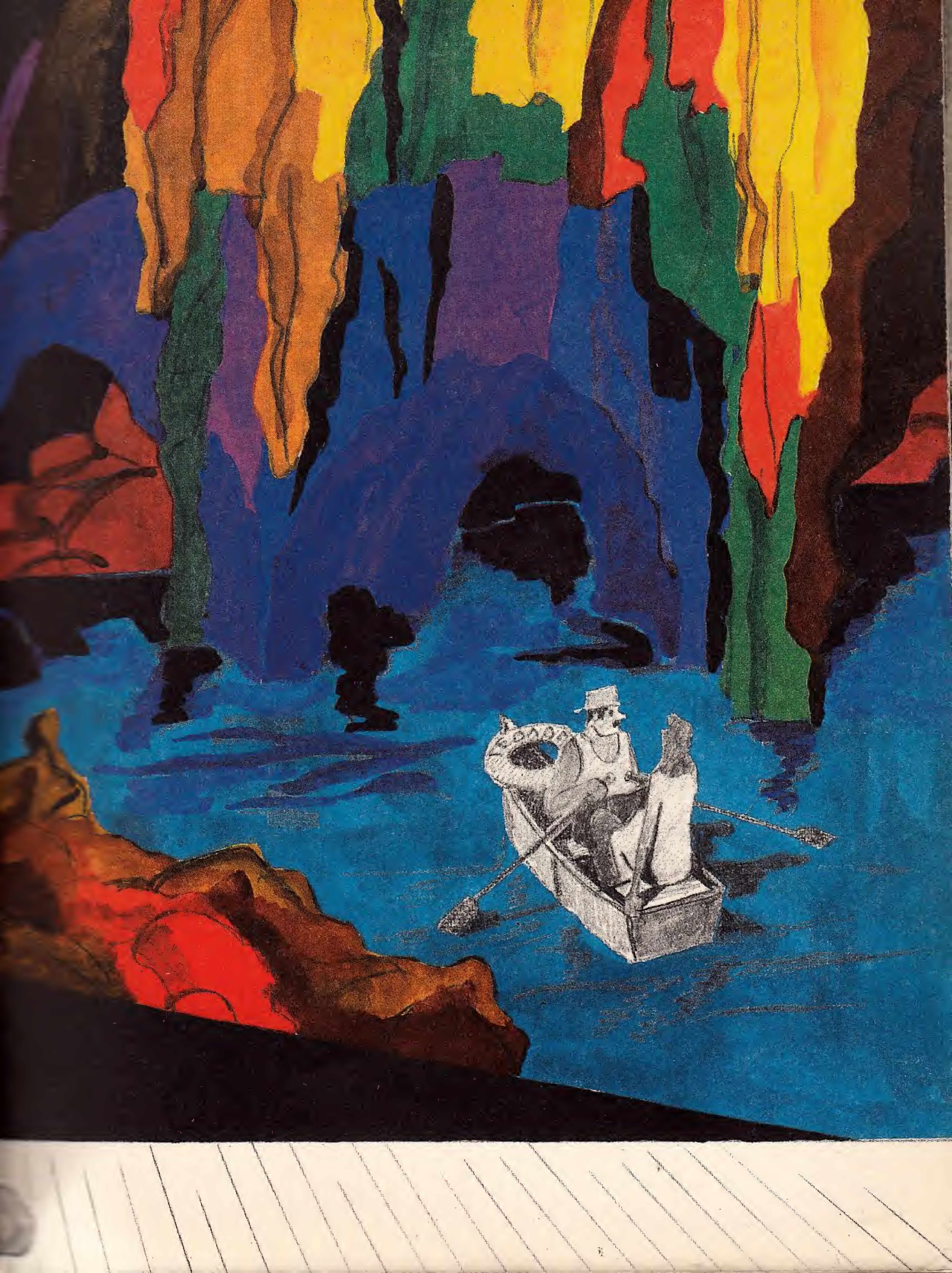
How are underground caves formed?

Underground caves are most often found where underground rivers used to run. The water would wash away the soil and the softer rocks, and an empty space would be formed underground—a natural cave.

Such caves can be as large as cities, with streets and alleyways. And they can be as high as ten-storey buildings.

Geologists study all caves very carefully. Not only because they may find mineral deposits in them. When geologists go deep down below the Earth's surface they can also study the structure of the Earth itself.





4. HOW GEOLOGISTS WORK

Mysterious traces

A geologist must always have an observant eye. When he comes to a mountain he looks at it very carefully: what kind of rocks there are, what kind of streams and how they are flowing, what flowers and grasses are growing on the mountain sides. All these things are very important to a geologist.

He looks at all these things carefully because iron, and coal, and all the many other mineral deposits hidden within the Earth leave traces on the surface. We only need to be able to see and recognise them.

For example...

A geologist is on an expedition through a dense forest. He comes upon a stream. He sits down near it, looks at it and tastes it. And he thinks to himself: why is the water such a gingery colour?

Someone who is not a geologist would just walk past without noticing it: it's a stream, just like any other, nothing special. But the stream will tell a geologist a lot. If the water is a greyish colour, then the soil round about is fertile. If it's yellowy, then there's clay down below. But if the water is a rusty, gingery colour, then there may well be an iron ore deposit underground nearby.

The geologist sits there by the stream, looking around and marking the stream carefully on his geological map. And in his field diary he writes: look around the area in more detail, there should be iron ore not far away.

So you see how it happens. The iron may be hidden a long way underground, but the stream brings its traces to the surface. A geologist notices these traces, and recognises them for what they are.

How oil was found

There was once a village where the old people used to believe that real, live spirits walked the Earth. No matter how much the younger villagers tried to persuade them that the idea of spirits, ghosts and devils was all just part of their imagination, the old people stuck to their belief.

"You just go down to the marshes!" they would say. "You go, and you'll see for yourselves that evil spirits live there."

One evening some of the older schoolboys got together and set off for the marshes.

It grew dark, and the mist gathered. All was deadly quiet, but they could just make out a light rustling noise and a quiet crackling sound. They began to feel afraid, just a little, but they didn't leave. They sat and watched, keeping each other's spirits up as best they could.

And suddenly they saw mysterious blue lights running through the marshes. Sometimes quite bright, sometimes they would go out altogether. It really was as though there was someone there, someone invisible lighting their way with a torch. Perhaps it really was the work of the devil.

The boys couldn't make out where these blue lights were coming from, or what caused them. Someone suggested they ask geologists, which they did.

The geologists grew interested, and a team of them arrived in the village.

All the talk about devils and evil spirits, of course, was pure nonsense. The geologists explained that the blue lights were made by marsh gasses burning. And in the daytime people could clearly see large bubbles coming to the surface of the marsh water. These bubbles would burst into the air with a light rustling sound.

The geologists also explained to the villagers that the marsh gas showed there were deposits of oil underground.

So a drilling rig was brought to the marshes, and soon a rich black fountain was pouring out where there had once been "evil spirits".


E=mc²

Where did you find these flowers?

One day some flowers were brought into a geology laboratory. But they weren't for putting in a vase to look pretty. These flowers had been brought for study and analysis. The bluebells, white camomiles and forest violets were to be examined with special laboratory instruments.

And suddenly the geologist examining the flowers cried out:

"Where did you find these wonderful, remarkable flowers?"

The person who had brought the flowers explained where he had picked them. The geologist thanked him and said it was an important find.

But what is so important or wonderful about ordinary bluebells and camomiles? And why should anyone want to know where they were picked? Does is matter?..

Yes, it does matter, very much!

Because flowers, using their roots, take up water from the soil around them. And this water, as it rises up through the ground, carries with it particles of the rocks it passes through. And these particles stay in the flowers. There are so few particles in a flower, of course, that we cannot actually "see" them with our eyes, but special equipment in a geologist's laboratory can find them easily.

The geologist had thus discovered that the violets contained traces of cobalt and nickel. This meant that these two rare metals were hiding underground where the violets had been growing.

Special equipment helped the geologist to make his important discovery.

Attention! Detonate!

A team of geologists pitched their camp deep within a forested area. Then they used a drilling machine to dig a deep hole in the ground. Into this hole they carefully lowered a pack of dynamite.

The team's leader called out:

"Attention! Everyone keep well away! Prepare to detonate!"

The camp fell silent, and the geologists watched their instruments intently.

The leader gave the command:

"Detonate!"

The silence of the forest was shattered. The echo of the blast carried for many kilometres around. The ground shook under the geologists' feet. And the needles on their instruments moved rapidly to and fro.

But then the sounds of the blast faded away. The geologists broke camp, loaded their things into their landrovers and moved further on into the forest. All was quiet once more, the only sound was the rustling of the trees in the wind.

So what was the explosion for?

The dynamite was set off deep under the surface of the Earth, and the result was a small earthquake. Nothing dangerous for people, but extremely useful for science.

Watching their instruments, the geologists could see how the blast spread through the rocks underground. Because the blast passed through different rocks differently. And if there were deposits of coal, oil or iron underground, then the instruments would clearly show them.

Mineral deposits respond to underground explosions just as clearly as if they shout: "Here we are!"

Journey into the depths of the Earth

The geologists have made their underground explosion and the instruments have clearly shown: in this place there should be iron ore. So how do they check this? A transportable drilling rig is brought to the place, and the journey into the depths of the Earth begins.

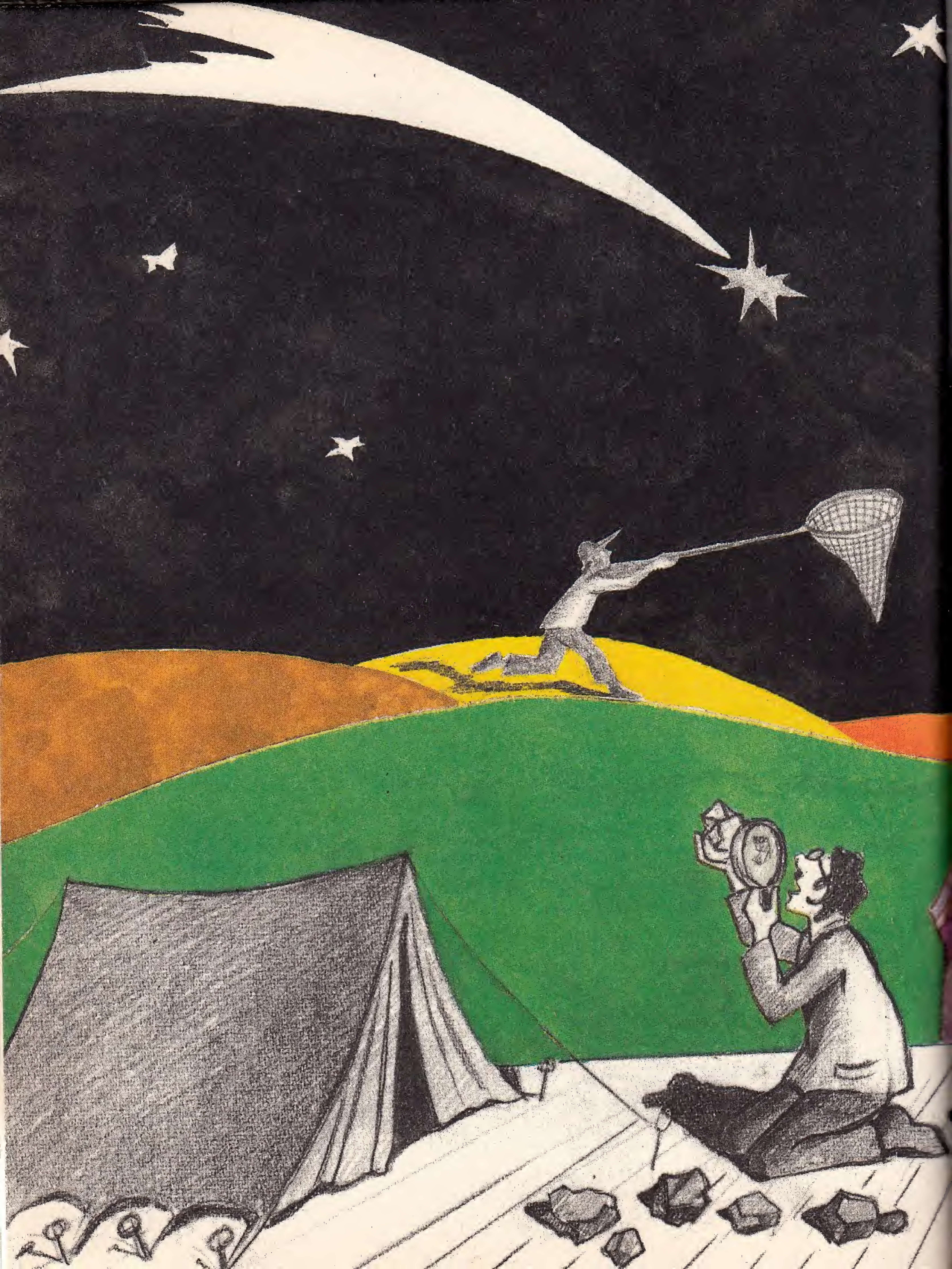
The steel shaft of the drill turns rapidly. It bites into the ground and can dig through even the hardest rock.

Soon the geologists take a sample of rock from the bottom of their drill hole. This sample is then analysed in a laboratory.

The results of the explosion were correct: a small amount of iron ore is found in the sample, but only a very small amount.

The geologists decide to carry on drilling, again the rig begins to whirr and again the steel shaft begins to turn rapidly.

Another sample. Ah! More iron this time.



Each new sample helps to determine where, at what depth, the iron ore deposit is to be found.

And when the transportable drill has finished its work, the geologists have the exact "address" of this new iron ore deposit.

Now it is the turn of the builders to come and set up a mine for excavating the ore.

Then the newspapers will announce: "New Iron Ore Mine Begins Work! The first hunderd tons of iron ore have already been mined."

But the geologists have moved on. The search continues.

The scout in the sky

We can talk for a very long time about the science of geology and about the amazing discoveries made by geologists. But this little book is coming to an end.

You have already learnt how the face of our planet has changed, what mineral deposits are and how geologists find them. But I want to tell you about just one more thing—the future. About what a geologist's work will be like in the future, and how the science of geology will develop. Let us just imagine...

An aeroplane is up in the sky. A geologist is sitting in a separate compartment, and he is surrounded by instruments. This is no ordinary aeroplane, it is a flying geological scout.

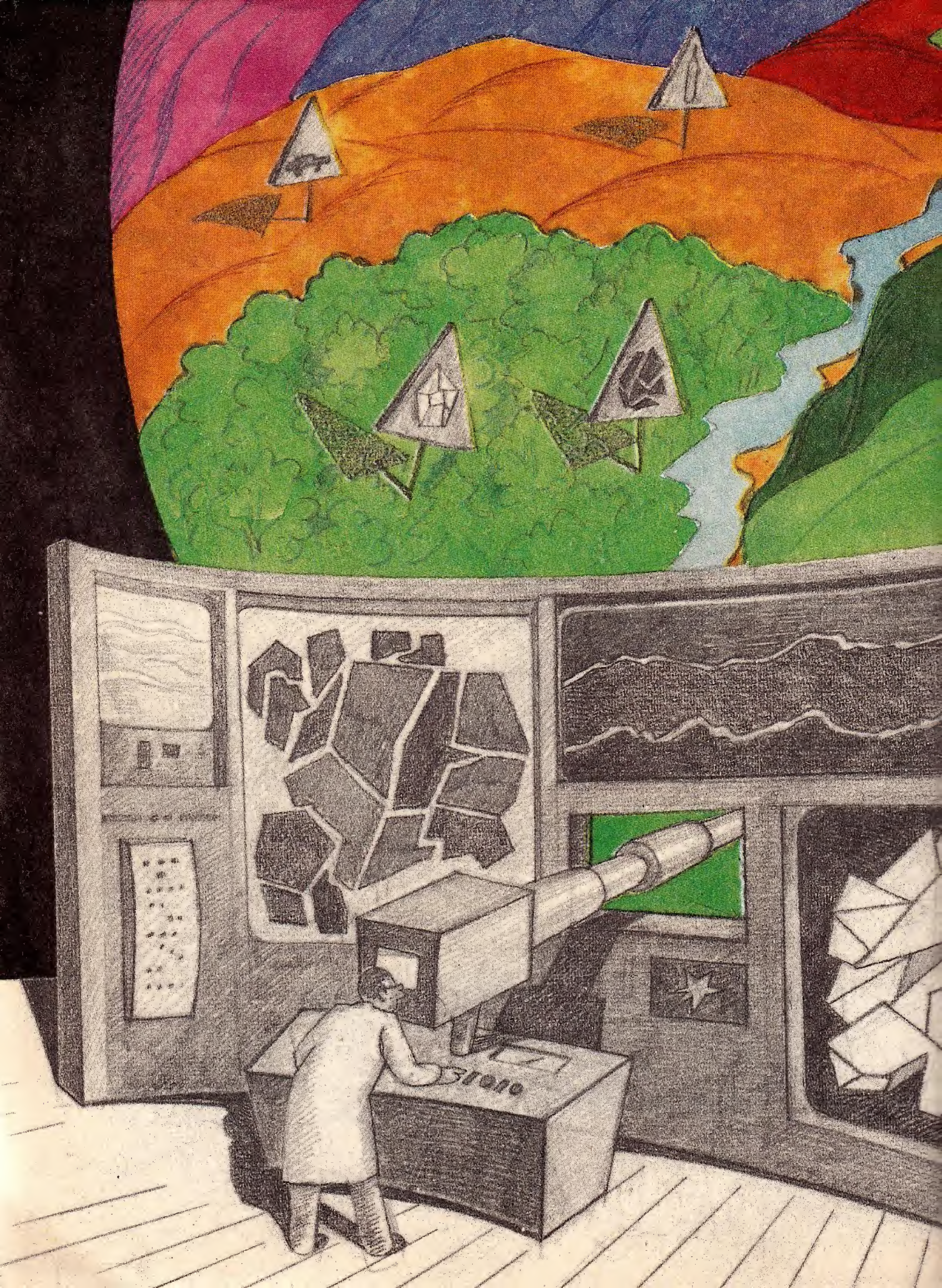
The geologist is carefully watching the dials on his instruments. They will show him what mineral deposits are hiding underground in the places the aeroplane is flying over.

If the dial of an instrument lights up red, then that means there is iron ore below. If the dial shows blue, then the geologist knows the aeroplane is flying over an underground lake. A green light on the dial is yet another signal: down below there are deposits of coal. The instruments can also show the exact location of oil, gold, marble, lead, and many other minerals.

From his compartment in the aeroplane the geologist sends radio messages to other people on the ground. Then drilling rig will be sent to the places where the minerals are to be found. And perhaps this will not be the drilling rig we know today: the heavy drilling tower and steel shaft will be replaced by a sword of fire. The drill operator will simply press a button, and a blinding flame will burn its way into the Earth. Even the toughest granite will not be able to resist it. The flame will quickly carve out a path to the riches hidden under the Earth's surface.

Let us also not forget that outer space, too, is waiting for the geologist. Geologist will certainly be among the first passengers alongside astronauts in the spacecraft of the future. And they will study the Moon, Venus, Mars and the more distant planets, discovering what these are hiding in their depths.

So you see, a bright future awaits the important science of geology.



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This book tells children about geology which literally means the study of the Earth, about people who search for minerals, and many other things.

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